NGDA Dataset Report

Official NGDA Title: USGS National Geologic Map Database Collection

Metadata Record Title: USGS National Geologic Map Database Collection

A–16 NGDA Theme: Geology

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Metadata:

Registration Status: Complete
Registered on 2/13/2013

GeoPlatform Link*: https://www.geoplatform.gov/node/243/da679621-ccd6-49aa-a6db-75fc791a4833

Data.gov Metadata Link*: http://catalog.data.gov/harvest/object/349a05bb-e25d-4267-9bd9-fec24c1798c8/html

*If the metadata has been updated and reharvested after publication of this report, the link may no longer be valid. The dataset may be searched for manually in Data.gov or GeoPlatform.gov.

NGDA Lifecycle Maturity Assessment (LMA) Report

Time Frame:

Baseline assessment responses include dataset activities from early 19th century to 2015.

LMA Submission:

Status: Complete

Date: 10/16/2015

Extension Requested: Yes

LMA Reviewer(s):

Supervisor: Did not review

Theme Lead: John Brock (jbrock@usgs.gov)

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SAOGI*: Did not review

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Attachments:

To get access to any attachments referenced in the report, email the LMA Help Desk at NGDA_LMA_help@fgdc.gov. Please use the subject "Dataset Report Attachment(s)" and indicate the associated official NGDA title.

*Senior Agency Official for Geospatial Information (SAOGI)

Lifecycle Maturity Assessment (LMA) Summary

Overall Maturity:

Mature; Consistent

General Questions: 73%

Mature; Consistent

Stage 1 - Define/Plan: 85%

Mature; Consistent

Stage 2 - Inventory/Evaluate: 100%

Optimized; Established

Stage 3 - Obtain: 75%

Mature; Consistent

Stage 4 - Access: 100%

Optimized; Established

Stage 5 - Maintain: 75%

Mature; Consistent

Stage 6 - Use/Evaluate: 77%

Mature; Consistent

Stage 7 - Archive: 66%

Managed; Predictable

NGDA Dataset Maturity Definitions:

How To Calculate Maturity: https://www.geoplatform.gov/sites/default/files/How_to_Calculate_Maturity.pdf

Maturity	Maturity Characteristics for All Lifecycle Stages
Optimized; Established Rank = 5	Dataset meets virtually all business needs of all users. The dataset is considered authoritative by owners and secondary users. It is curated across all stages of the approved lifecycle. Future needs are defined on a regular basis and resources for addressing both current and future business requirements are available.
Mature; Consistent Rank = 4	Dataset meets all the business needs of the primary owner and most of the secondary users. The dataset is curated and used as authoritative by the primary owner. Dataset is used widely by secondary users actively engaged in sustaining the dataset. Future needs are identified and steps are planned to address these. All stages are supported and reviewed on a recurring basis. The dataset is well managed in relation to the approved lifecycle.
Managed; Predictable Rank = 3	Dataset meets a significant number of the business needs of the primary owner and is widely used as an authoritative resource by secondary users. Benchmark activities are occurring in at least four of the approved lifecycle stages. Management practices in relation to the approved lifecycle is moderate but consistent. Dataset is integrating changing business requirements in lifecycle stages impacting overall maturity.
Transition; Transformation Rank = 2	Dataset meets business needs of the primary owner and has moderate use by secondary users. Benchmark activities are occurring in at least three stages. Efforts to integrate funding, include partners, and obtain data are not supported in a sustained manner. Management practices in relation to the stages of the approved lifecycle is limited.
Planned; Initial Development Rank = 1	Dataset limited in meeting business needs of the primary owner. Benchmark activities in the approved lifecycle are just starting to consider secondary uses, partnerships are forming to support additional dataset uses. Dataset development is in a very early stage. Minimal or limited management against the benchmarks in the approved lifecycle.
No Activity Rank = no activity	Dataset meets project or local business needs of the primary owner, secondary or additional uses or users were not considered, not recognized as an authoritative data or is part of a similar dataset. Not managed to any of the benchmarks in the approved lifecycle.

General Questions for All Stages

1) Is there a recurring process to obtain funding for all lifecycle stages of this dataset?

Answer: Funding support exists but is not adequate to meet known requirements, most lifecycle stages are supported.

Justification Comment: **Attachment(s):** 0

The dataset for geologic mapping is a collection of data, observations, and interpretations that are found in individual geologic maps and reports, both published and unpublished. This vast collection is supported by an evolving set of geoscience and technical standards, developed in cooperation among the partners who contribute to the collection. Together, this standardized collection ("dataset" in NGDA terms) is designated as the National Geologic Map Database (NGMDB, http://ngmdb.usgs.gov/). This collection includes some individual GIS datasets, but the majority of the information is in the form of scanned (raster) copies of individual maps and reports, and the bibliographic citations and web links to downloadable copies.

The NGMDB is Congressionally mandated, in the Geologic Mapping Act of 1992 (http://ncgmp.usgs.gov/about/ngm_act/ngmact1992.html) and its Reauthorizations (most recently in 2009, http://ncgmp.usgs.gov/about/ngm_act/ngmact2009.html). The Geologic Mapping Act established the National Cooperative Geologic Mapping Program (NCGMP, http://ncgmp.usgs.gov), administered by the U.S. Geological Survey (USGS) in order to provide funding for geologic mapping by USGS, the State Geological Surveys, and Universities. The NGMDB is identified as the Act's sole purpose, in Section 31a(b) as follows:

"The purpose of sections 31a to 31h of this title is to expedite the production of a geologic-map data base for the Nation, to be located within the United States Geological Survey, which can be applied to land-use management, assessment, and utilization, conservation of natural resources, groundwater management, and environmental protection management."

The Geologic Mapping Act of 1992 established the NCGMP as the funding source for geologic mapping and for the NGMDB. When the NGMDB was initiated in 1995, funding was adequate to support all requirements. Over the succeeding 20 years, funding decreased to approximately 20-25% of the 1995 level. Concurrently, computer technology and the public's expectations for delivery of information have advanced dramatically, necessitating a significant broadening of the NGMDB's scope and increased investment in technology. Therefore, funding support is quite inadequate to support public and legislative demands on the NGMDB.

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2) Is there a process in place to ensure that open government and transparency guidelines are followed in all lifecycle stages for this dataset?

Answer: Process is published as appropriate with respect to sensitivity requirements, process is transparent, published appropriately.

Justification Comment: **Attachment(s):** 0

The Geologic Mapping Act of 1992 (http://ncgmp.usgs.gov/about/ngm_act/ngmact1992.html) and its Reauthorizations (most recently in 2009, http://ncgmp.usgs.gov/about/ngm_act/ngmact2009.html) stipulate that the NGMDB will be a "national archive" of geoscience information "which can be applied to land-use management, assessment, and utilization, conservation of natural resources, groundwater management, and environmental protection." Therefore, the published information in the NGMDB (e.g., USGS Director's Approved maps and reports) is freely available to all users. Information that has not been approved for publication (e.g., unpublished notes and internal reports that describe paleontologic and stratigraphic samples) is made available to users upon request, via a password-protected web site.

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3) Are there processes and tools in place so that staff are sufficiently knowledgeable to ensure a continuity of the dataset for all stages of the lifecycle, especially during staffing transitions?

Answer: Processes and tools to ensure dataset continuity are under development.

Justification Comment: **Attachment(s):** 0

The NGMDB is built, maintained, and administered by a relatively small staff (6 permanent and 3 contract employees, a total of ~5 FTE). Most staff members have worked for the NGMDB project for its entire 20 years of existence. Additional support to the project is obtained by volunteer cooperators in the State Geological Surveys and University Libraries. For aspects of the NGMDB workflow that involve the volunteers (e.g., adding bibliographic citations and scanned map images to the NGMDB Map Catalog), documentation on workflow and content standards is available at the NGMDB Web site (e.g., at http://ngmdb.usgs.gov/Info/partners.html and http://ngmdb.usgs.gov/Info/standards/) or published in Proceedings of the Digital Mapping Techniques workshops (http://ngmdb.usgs.gov/Info/dmt/). Documentation of the internal workflow of the NGMDB project, and maintenance of the database infrastructure, is less mature, for two reasons. First, the project has a very small staff, most of whom have worked on the project for the full 20 years of its existence. This situation tends to lead to focus on daily tasks rather than long-term tasks such as workflow documentation. However, new project members are beginning to replace the original staff, which will necessitate detailed documentation of the workflow, code base, and database design. Second, within the past two years, the project has embarked on a complex task to refine or rewrite its code base and to establish a more resilient, secure computer infrastructure. As this work reaches its conclusion, the project will be fully documenting all processes and infrastructure.

STAGE 1 - Define/Plan

4) Are user and business requirements defined and formalized?

Answer: A recurring process is in place, including defining new partner and stakeholder business needs as they arise, and is fully implemented.

Justification Comment: **Attachment(s):** 0

Referring again to the NGMDB's authorizing legislation, the Geologic Mapping Act of 1992, the purpose is to build a national resource "which can be applied to land-use management, assessment, and utilization, conservation of natural resources, groundwater management, and environmental protection." This statement of requirement is closely followed by the NGMDB. Further, daily interaction with users is solicited via Comments and Corrections web forms that are located on each NGMDB page. From the comments received, and from NGMDB project staff's investigation of emerging technologies, significant enhancements to the NGMDB's content and information delivery have been implemented. For example: (1) the Map Catalog (http://ngmdb.usgs.gov/ngm-bin/ngm_compsearch.pl) and U.S. Geologic Names Lexicon (http://ngmdb.usgs.gov/Geolex/search) were redesigned in order to provide more flexible searches and a wider scope of science content; and (2) interactive viewers for geologic and topographic maps (http://ngmdb.usgs.gov/maps/mapview/ and http://ngmdb.usgs.gov/maps/TopoView/) were designed for easy access by the general public.

5) How are partners/stakeholders involved in the requirements collection process?

Answer: A recurring process is in place, including defining new partner and stakeholder business needs as they arise, and is fully implemented.

Justification Comment: **Attachment(s):** 0

The Geologic Mapping Act of 1992 stipulated the NGMDB as a collaborative responsibility of the USGS and the State Geological Surveys (represented by AASG, the Association of American State Geologists). Therefore, the NGMDB was defined and established after extensive discussion amongst these stakeholders, culminating in 1995 in a public statement of intent (http://ngmdb.usgs.gov/Info/reports/geotimes95.html). Continuously since then, the NGMDB has been reexamined by the stakeholders and refined as needed. This reexamination is facilitated by discussion at public venues (e.g., scientific and stakeholder meetings, and the annual Digital Mapping Techniques workshops (http://ngmdb.usgs.gov/Info/dmt/)) and in published techniques and standards

articles and reports of progress (e.g., in Proceedings of the Digital Mapping Techniques workshops). Other stakeholders have been identified (e.g., the National Park Service, the Association of Independent Professional Geologists, American Association of Petroleum Geologists), and their input and requirements are carefully considered.

6) Is there a quality assurance process for the dataset?

Answer: Process established, significant portions of the documentation is complete.

Justification Comment: **Attachment(s):** 0

Numerous quality-control measures have been developed, and are implemented continuously. These include: (1) scripts to check for broken links to collaborator and other publisher's web sites and downloadable maps and reports; (2) programming logic to identify errors in data input (e.g., bibliographic citations and links) by collaborators; (3) daily use of the NGMDB by project staff, through which content errors are identified and corrected; and (4) errors reported by users, via the Corrections web form.

7) Is there a process to evaluate the sensitivity, privacy, and confidentiality of this dataset?

Answer: Sensitivity, privacy, and confidentiality evaluations fully implemented, reviewed and updated on a recurring basis.

Justification Comment: **Attachment(s):** 0

Nearly all information in the NGMDB is published and freely available (e.g. , as USGS or State Geological Survey Director's Approved maps and reports). The exception is a limited amount of information managed by the NGMDB that has not been approved for publication. Specifically, these are: unpublished maps; annotations of a scientific nature found on copies of published maps; and most significantly, USGS notes and internal reports that describe paleontologic and stratigraphic samples and provide provisional interpretations – these are made available to users upon request, via a password-protected web site. The provisional nature of this information, and restrictions on usage, is emphasized. In addition, certain "gray literature maps" that were funded by a grant from the National Cooperative Geologic Mapping Program's EDMAP component are made freely available through the NGMDB, but each map image is watermarked with an indication that the map is provisional.

8) Are defined data standards used in collecting, processing, and/or rendering the data?

Answer: Standards developed and/or selected.

Justification Comment: **Attachment(s):** 0

Standards for geologic mapping, including geologic time and stratigraphic nomenclature, have existed since the late 19th century. These range from agency-adopted common practices to widely accepted standards developed by international bodies (e.g., the North American Commission on Stratigraphic Nomenclature). A common suite of standards are generally followed by the Nation's principal agencies that conduct geologic mapping (i.e., USGS and the State Geological Surveys). Differences in geologic map content and emphasis (e.g., mineral or water resources, or hazards) do exist, but the fundamental science aspects (e.g., geologic time, conceptual agreement on what constitutes a mappable geologic unit, stratigraphy, lithologic descriptors), are reflected in the relatively uniform nature of geologic maps. The NGMDB is charged under the Geologic Mapping Act of 1992 with reexamining these standards and updating them as needed for implementation in a digital publication process and incorporation in the Database. The cartographic standards used for conventionally printed maps have been updated for digital maps, and released as a FGDC Standard (http://ngmdb.usgs.gov/fgdc_gds/). A format and content standard for publication of the geologic map database (http://ngmdb.usgs.gov/Info/standards/NCGMP09/) is nearing final revision before being proposed as a FGDC Standard. Other standards, including NGDMB-specific workflow and content, are completed or under development (see various links under http://ngmdb.usgs.gov/Info/).

STAGE 2 - Inventory/Evaluate

9) Is there a process for determining if data necessary to meet requirements already exist from other sources (either within or outside the agency) before collecting or acquiring new data?

Answer: Process for determining appropriate data is being reused fully implemented, reviewed, and updated on a regular basis.

Justification Comment: **Attachment(s):** 0

Geologic mapping is conducted almost exclusively by State Geological Surveys and by a few Federal agencies. These geologic mapping organizations are in close contact with one another, which minimizes the possibility that suitable, preexisting mapping already exists for an area that is proposed to be geologically mapped. The NGMDB Map Catalog also serves as the authoritative record of all geologic mapping of the Nation, and can be consulted in order to identify potential duplication of effort. Most significantly, agency review boards (e.g., State Mapping Advisory Boards) determine the areas to be geologically mapped; this serves to prioritize areas for geologic mapping, and strongly considers any possibility that previous mapping of the area is suitable for the societal issues that need to be addressed.

STAGE 3 - Obtain

10) Is there a process for obtaining data in relation to this dataset?

Answer: Process is fully implemented, reviewed and updated on a regular basis.

Justification Comment: **Attachment(s):** 0

The National Cooperative Geologic Mapping Program (NCGMP, http://ncgmp.usgs.gov) administers the funding of a large proportion of the Nation's geologic mapping. Through the NCGMP's process of identifying areas to be geologically mapped, new information is added to this dataset (the NGMDB) on a continuous basis. There are other Federal and State programs that fund geologic mapping; the maps from these programs are incorporated into the NGMDB to the extent possible (i.e., given resources available to identify these maps and add bibliographic content to the NGMDB).

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11) Is the metadata in a FGDC endorsed geospatial metadata standard?

Answer: Metadata is available in a format endorsed by the FGDC, it fully describes the dataset and provides all the information required to make the dataset discoverable, accessible, and usable.

Justification Comment: **Attachment(s):** 0

The information in this dataset consists of bibliographic citations, text descriptions of stratigraphic nomenclature, scanned (raster) maps, and Web links. GIS data is not stored and managed in the NGMDB, and so FGDC geospatial metadata is not managed directly. However, the GIS data published by USGS and the State Geological Surveys (which is identified in the NBMDB by a bibliographic citation) has FGDC metadata. And so, indirectly through the NGMDB, the GIS data and associated FGDC metadata can be accessed. Further, selected NGMDB records that are uploaded to Data.gov are supported by FGDC metadata (the provisional set uploaded to Data.gov is limited to ~7,500 NGMDB records for which vector GIS data or geoTIFFs are available).

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12) How complete is the geographic coverage as defined in the requirements for the dataset?

Part 1 Answer: Business requirement targets are on track, milestones are being met.

Part 2 Answer: Data set is roughly 50% of the geographic coverage is presently complete per current requirement.

Justification Comment: **Attachment(s):** 0

The NGMDB includes bibliographic citations for >99,000 geoscience maps and reports; among these are >38,000 publications focusing on bedrock or surficial geologic mapping. The coordinates of each

map's bounding box are recorded in the NGMDB. However, many geologic maps are not rectilinear in outline (e.g., a geologic map of a mining district, or a particular belt of rocks), and so a computation of the areal coverage of such geologic maps would be highly inaccurate. Therefore, in response to government requirements for "productivity metrics" for funding provided by the National Cooperative Geologic Mapping Program, the NGMDB project computes the geographic coverage of geologic mapping by considering only those maps that are rectilinear, or presumed to be nearly so. The process of determining which maps to include in the computation is complicated and relies on judgment and experience in performing this task each year, in order to be as consistent as possible from year to year. The basic methodology is described in http://pubs.usgs.gov/of/2005/1428/pdf/soller2.pdf. Because the process summarizes the total land area for which a geologic map is available, it is largely dependent on state and locally prioritized needs for mapping, which focus on the most pressing societal issues. If these societal issues applied equally to all areas of the Nation, then it could be foreseen that all areas of the country would soon be mapped at the relatively detailed scales (1:100,000 and more detailed) that are considered by this metric. However, for vast areas of the Nation (e.g., in Alaska and the midcontinent), geologic mapping has been done only at a reconnaissance level (e.g., 1:250,000), and it is unlikely given the nature of the geology, the population density in those areas, the nature of the most pressing societal issues, and the level of funding, that a large amount of more detailed mapping will be conducted in the near future. Instead, NCGMP funding more commonly is applied to remapping high-priority areas, with the purpose of providing more detailed and modern geoscience information. With these caveats, we can state that, at scales of 1:100,000 and more detailed, 52.5% of the Nation has been geologically mapped.

STAGE 4 - Access

13) Do you have a process for providing users access to the data in an open digital machine readable format?

Answer: User access process is fully implemented, data is available, process is reviewed and updated on a recurring basis.

Justification Comment: **Attachment(s):** 0

All published information in the NGMDB is freely available. The publishing agency (e.g. , USGS, State Geological Survey) manages and disseminates the machine-readable information which, depending on the product, may be in various text, image, or GIS formats. The NGMDB provides the search mechanism and links to the publishers, to facilitate access to the information. The NGMDB also provides downloadable raster versions of the many of these publications, in TIFF, JPEG, PDF, and KMZ formats. More than 21,000 publications accessed from the NGMDB have publicly-available images of geologic maps and other oversize plates (totaling more than 35,000 separate map plates). As noted above, several image formats are available for download. For USGS publications, all of the four formats are offered, whereas for State Geological Survey publications, separate agreements with each agency are reached, and the number of downloadable formats for those publications range from zero to four. In total, the NGMDB manages more than 129,000 images in these various formats.

STAGE 5 - Maintain

14) Is there a maintenance process for updating and storing the dataset?

Answer: Dataset maintenance process is identified and documented.

Justification Comment: **Attachment(s):** 0

The NGMDB's content is continually maintained; updates occur whenever new publications are released by the cooperating agencies. Regarding maintenance of the infrastructure (e.g., hardware, software, code base, data storage and backups), as noted in Questions 1 and 3, owing to the declining budget and small staff, within the past two years the project has embarked on a complex task to refine or rewrite its code base and to establish a more resilient, secure computer infrastructure.

15) Is there an error correction process as part of dataset maintenance?

Answer: Error correction process includes user notification, process reviewed on a recurring basis.

Justification Comment: **Attachment(s):** 0

As noted in Question 6, numerous quality-control measures have been developed, and are implemented continuously. These include: (1) scripts to check for broken links to collaborator and other publisher's web sites and downloadable maps and reports; (2) programming logic to identify errors in data input (e.g., bibliographic citations and links) by collaborators; (3) daily use of the NGMDB by project staff, through which content errors are identified and corrected; and (4) errors reported by users, via the Corrections web form. Any identified errors are immediately corrected in the database, and appear in the NGMDB web pages.

STAGE 6 - Use/Evaluate

16) Is there a process to determine if the dataset meets user needs?

Answer: Process is fully implemented and repeated on a recurring basis.

Justification Comment: **Attachment(s):** 0

In Question 4, the process for defining user requirements was described. For the NGMDB, that process involves continual assessment to determine whether user requirements are actually being met. Daily interaction with users is solicited via Comments and Corrections web forms that are located on each NGMDB page. These user comments, and discussions with NGMDB collaborators and in public forums (e.g., scientific meetings, presentations to professional societies and other user groups) provide the basis for determining if the NGMDB is meeting user needs. In addition, website-usage logs are monitored on a monthly basis. These logs indicate a steady increase in the public's use of the NGMDB over the 20 year period.

17) Is there a process to provide users information on how to access and properly use the dataset?

Answer: Process implementation started for access and proper use.

Justification Comment: **Attachment(s):** 0

The NGMDB assists users in understanding how to access and use the information by two principal methods. First, to explain how to use the website, Help pages are provided with each of the NGMDB's components (e.g., http://ngmdb.usgs.gov/ngmdb/ngmdb_help_comp.html, http://ngmdb.usgs.gov/Geolex/help, http://ngmdb.usgs.gov/maps/mapview/, http://ngmdb.usgs.gov/maps/TopoView/help/). Because of the complexity of the new topoView interface, a tutorial was prepared and posted to YouTube (https://www.youtube.com/watch?v=kOpe3WXsZrQ). These Help pages will be reviewed, and revised as necessary, in order to improve their usability. Second, to explain how to use the information, users are invited to submit comments and questions via the Comments web form. In addition, many of the publications available through the NGMDB contain guidance on proper use of the geoscience information.

18) Are the business processes and management practices assessed to meet changing technology?

Answer: Assessment process implementation started for taking advantage of changing technology.

Justification Comment: **Attachment(s):** 0

The NGMDB staff reviews current and emerging computer technology and the public's expectations for delivery of information. The costs and benefits (in a strictly qualitative sense) of using emerging technologies to provide new methods for accessing the NGMDB are carefully considered and, given available funding, plans are made to adopt these technologies. For example, the first version of the NGMDB's redesigned image-viewing capability uses Flash technology (http://ngmdb.usgs.gov/Prodesc/proddesc_2454.htm) in order to minimize implementation and maintenance costs. However, the well-known problems with Flash (e.g., vulnerabilities) will necessitate rewriting the code in JavaScript; this has the further advantage of enabling use of the

NGMDB's image-viewing capability on all mobile devices. An example of the Flash-based viewer is "mapView" (http://ngmdb.usgs.gov/maps/mapview/), and the example of the JavaScript rewrite is "topoView" (http://ngmdb.usgs.gov/maps/TopoView/). TopoView is being used as the testbed for rewriting the code for other image-viewing components of the NGMDB. Upgrades to those components and revisions to other aspects of the NGMDB will be done when funding and staff time permit.

STAGE 7 - Archive

19) Is there an archiving process for the dataset?

Answer: Archival and/or processes are in early implementation.

Justification Comment: **Attachment(s):** 0

The NGMDB holds ~24 TB of image content, workflow scripts, and an extensive RDBS of geoscience content that has been built over a 20 year period. At present, this information resides at the Denver Federal Center (DFC) on NGMDB-owned servers and mass storage devices that are RAIDed. The system was being backed up to a tape archive. In order to provide redundancy and to increase the security of the data, the following is being done: (1) a failover system containing a public web server and data backup is being developed in a new facility at the DFC; (2) the NGMDB-owned servers will be moved to Reston, VA, in order to ensure geographic distance from the failover system; (3) an inexpensive data-backup device will be implemented in order to provide a third full backup of the entire system, and also will serve as the project's staging area for processing new data; and (4) the feasibility of cloud services and storage (including cost) will be assessed, so that before the NGMDB-owned servers reach end-of-life, the web server and perhaps the data can be migrated to the cloud. Because the NGMDB is a collaborative project with the State Geological Surveys, there is some redundancy; some States maintain their bibliographic data in the identical form used by the NGMDB. Further, many of the map images used in the NGMDB are available through the State Geological Surveys. Regarding the unpublished source information (mostly paleontologic and stratigraphic reports) referred to in Question 2, these exist as paper records. They are curated in a climate-controlled facility in Reston, VA., along with thousands of older published documents, reports, and maps that are used daily by the NGMDB project in order to improve the content of the NGMDB dataset. Many of those documents are unavailable in the USGS Reston Library or on the Internet, and so serve as an invaluable resource to the project and to visiting scientists.